Empirical Asset Pricing

You have two hours to complete the exam. The exam is open-book. Good luck!

1. **Cross-sectional asset pricing**

   (a) In the paper "Asset Pricing with Garbage" (Journal of Finance, 2011, February, pp. 177-202), Alexei Savov uses municipal solid waste (that is, "garbage") as a new measure of consumption. He shows that annual garbage growth is more correlated with stock returns than the canonical measure, that is, consumption expenditure growth. Assuming that garbage equals consumption (c_t), start from the Euler equation of consumption with power utility (see Cochrane's textbook, Chapter 1):

   $$E_t\left[\beta\left(\frac{c_{t+1}}{c_t}\right)^{-\gamma}R^e_{t+1}\right]=0$$

   where γ is the relative risk aversion coefficient, β is the subjective discount factor, and R^e_{t+1} is the excess return on a risky asset. Using Stein's lemma, derive a linearized version of the Euler equation. Make all the distributional assumptions that you deem necessary to apply the Lemma. (Hint: if X and Y are jointly normal random variables, and $f(x)$ is a differentiable function, according to Stein's lemma: $Cov\left(Y,f\left(X\right)\right)=E\left(f'\left(X\right)\right)Cov(Y,X)$. Also notice that $\beta\left(\frac{c_{t+1}}{c_t}\right)^{-\gamma}$ is the stochastic discount factor.)

   (b) From your result in part (a), obtain an expected-return-beta representation that you can use for cross-sectional tests. The betas in this representation are "garbage betas".

   (c) Explain how you would test the garbage-based consumption asset pricing model using the Fama and MacBeth (1973) approach. Describe each step in the approach and explain how you would account for time-series correlation of the cross-sectional estimates in computing the standard errors.

   (d) Does the Fama-MacBeth approach account for the fact that the betas are estimated? If not, what are the alternative approaches that are available to the econometrician to account for this issue?

   (e) In the paper, Savov runs a horse-race of the garbage-CCAPM against other asset pricing models. The results are in the table below. Compare the garbage-CCAPM to the Expenditure-based CCAPM (columns 1 and 3). Describe the absolute performance of each model, and rank their relative performance.

Table V

Fama–MacBeth Regressions

The test assets are the 25 Fama–French (1993) size and book-to-market portfolios and 10 industry portfolios. There is no cross-sectional intercept. The estimates follow the Fama–MacBeth (1973) cross-sectional procedure. R.m.s is the root-mean-squared pricing error with an associated p-value for the hypothesis that all pricing errors are zero in parentheses. Three-lag Newey–West t-statistics are also in parentheses. P–J is 3-year expenditure growth as in Parker and Julliard (2005); Q4–Q4 is the fourth-quarter year-over-year growth in expenditure as in Jagannathan and Wang (2007); and *cay* is the consumption-to-wealth ratio proxy from Lettau and Ludvigson (2001).

Garbage	Garbage × *cay*	Expenditure	Expenditure × *cay*	P–J	Q4–Q4	MRF	SMB	HML	r.m.s. (p)
2.44									3.42
(3.59)									(0.00)
2.06	0.34								3.21
(2.32)	(0.74)								(0.00)
		1.25							3.74
		(3.56)							(0.00)
		0.56	0.84						3.24
		(1.50)	(1.85)						(0.00)
2.38		0.57							3.42
(3.53)		(1.69)							(0.00)
				5.61					3.08
				(3.91)					(0.00)
					2.08				2.33
					(3.85)				(0.00)
						8.18			3.46
						(3.57)			(0.00)
1.92						8.01			3.41
(2.15)						(3.50)			(0.00)
		0.48				7.89			3.42
		(1.43)				(3.54)			(0.00)
						6.48	2.73	4.90	1.96
						(2.98)	(1.22)	(2.65)	(0.00)
−0.03						6.52	2.69	5.03	1.93
(0.04)						(2.99)	(1.21)	(2.74)	(0.00)
		0.10				6.51	2.72	4.82	1.95
		(0.34)				(2.99)	(1.22)	(2.59)	(0.00)

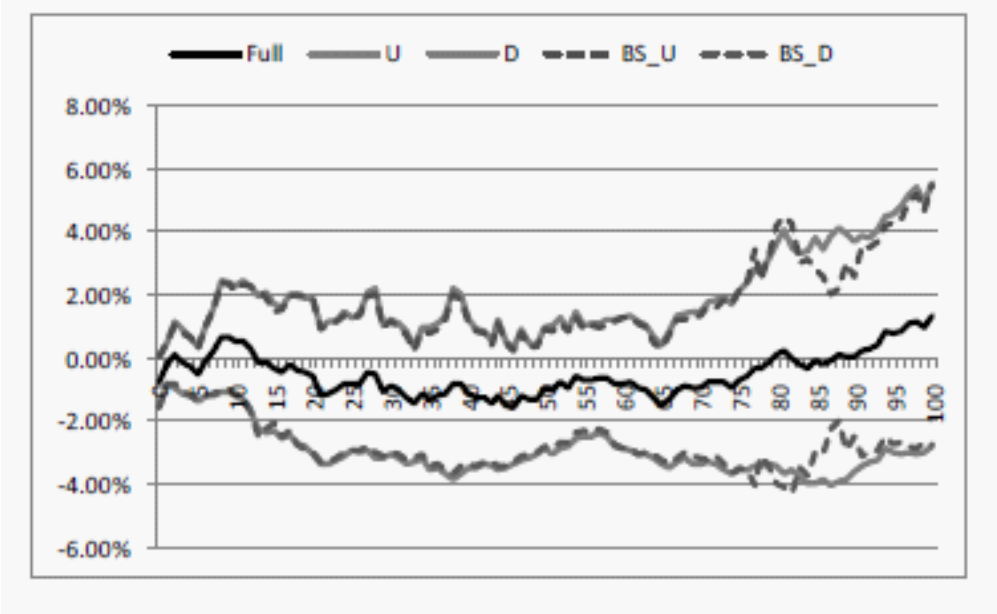
(f) Now, focus on the results in column 1 from the table above. If I told you that the $\beta = 0.95$, the standard deviation of garbage growth is 2.88% annually, and the average risk free rate in the sample is 5.52% annually, back out an estimate of risk aversion γ from the above regressions and the linearized Euler equation in part (c). Note that the estimates in the above table are in percent.

2. **Liquidity and Institutional Investors**

(a) In the working paper "Flight-to-Liquidity in the Equity Markets during Periods of Financial Crisis", Azi Ben-Raphael of Indiana University wants to assess the impact on stock returns of flights to liquidity. Define a flight to liquidity

(b) The paper defines "financial crises" as the ten months with the largest changes in the VIX index to date. Then, the author finds that the cumulative return of a portfolio that is long illiquid stocks and short liquid stocks earns a -2% significant alpha in the three months after a financial crises. Liquid/Illiquid stocks are defined according to quintiles of the distribution of the Amihud (2002) ratio. How could you profit from the -2% alpha in a trading strategy that replicates the exercise in the paper? (Hint: this is a tricky question)

(c) The cumulative abnormal return pattern of the illiquid-minus-liquid portfolio in the 100 days following the crisis is given below (focus on the dark black line)



This means that illiquid stocks in a crisis suffer more than liquid stocks, but over time this initial return difference is slowly reversed. Provide two stories that are consistent with this price pattern. Hint: one of the two stories does not need actual trading of illiquid/liquid stocks to stand. The other story does.

(d) The author finds that mutual funds as a group sell illiquid stocks at times of financial crises. Given this information, does the return pattern in the above figure reminds you of the results in another paper that we studied in class? Given the results from the paper we saw in class, what additional step does one need to make to generate the cross-sectional dimension of the above return pattern (that is, the difference in returns between liquid and illiquid stocks)?

(e) The author finds that, after a crisis, investors run on the mutual funds that hold especially illiquid portfolios of stocks. These funds sell their holdings on the market and this fact generates the price pattern in the above figure. This investor behavior can be generated by two stories:

i. Illiquid funds are more likely to suffer in bad times → Investors react to the poor returns of these funds and withdraw their capital.

ii. In bad times, investors try to be the first to get out of the fund, anticipating a run-for-the-exit (as in a bank run), exacerbated by asset illiquidity. That is, if

an investor is the last to get out of the fund, he will have to redeem at unfavorable terms, because the holdings of the mutual funds are illiquid and cannot be easily sold. So, the investor tries to be the first to get out.

In the first story, investors are backward looking and react to past performance. In the second story, investors anticipate that the illiquidity of the fund assets will hurt them and they try to get out as soon as possible. Propose a test that can separate the two stories. The dependent variable in this test should be the flows into a mutual fund. The data set is composed of different mutual funds that invest in stocks. You know the portfolio holdings of these funds.